REMARKS

This Amendment is being filed in response to the Office Action dated 30 July 2004.

1. Original Patent.

The Office Action indicates that the original patent or a statement as to the loss or inaccessibility of the original patent must be received before the reissue application can be allowed. Applicant respectfully requests that this requirement be indicated as already having been fulfilled.

The original patent was submitted with the reissue application on the original filing date. Appendix I of this Amendment provides a copy of the itemized postcard receipt that was filed with the reissue application and which lists the Original Letters Patent (item 8) as being among those items received by the United States Patent and Trademark Office (USPTO). A stamp bearing the serial number was affixed to the postcard by the USPTO prior to its return to the below-listed attorney's offices. In addition, Appendix I includes a copy of the Reissue Patent Application Transmittal letter which indicates in item 11 of the Accompanying Application Parts section that the Original Patent Grant, Ribboned Original Patent Grant was transmitted to the USPTO when the Reissue Application was filed. Furthermore, Appendix I includes a copy of the Certificate of Mailing by Express Mail that was filed with the application. This Certificate of Mailing also certifies that the correspondence included the Original Letters Patent.

Accordingly, the original patent has already been received by the USPTO in this reissue matter, and applicants respectfully

request that that this requirement be indicated as having been fulfilled.

2. Specification.

The Office Action objects to the disclosure because certificate-of-correction changes were indicated in the Preliminary Amendment rather than being entered without underlining. Appendix II of this Amendment provides replacement sheets for the filed copy of the original patent (6,366,619). The replacement sheets effect the certificate-of-correction changes as follows:

In column 1 line 54, replace "Nyquist-a type" with –Nyquist-type--.

In column 5 line 26, delete the "." after "symbols".

In column 6, line 18, delete the "," after the second "t_2".

In column 8, line 28, replace "t_{25}" with --$t_{2.5}$--.

In column 9, line 6, replace "t_{25}" with --$t_{2.5}$--.

In column 10, line 16, delete the "." after "pulses".

In column 10, line 48, delete the "." after "be".

In column 11, line 1, delete the "." after "system".

In column 11, line 14, replace "Delay element 138 delays modulated signal 74 so that peaks" with --peak--.

In column 11, line 15, replace "Peaks" with --Delay element 138 delays modulated signal 74 so that peaks--.

In column 13, line 57, replace "con strained" with --constrained--.

In column 14, line 44, replace "implements" with --implement--.

These changes have been made without using underlining or other amendment marks.

Accordingly, applicants respectfully request that the objection to the disclosure be removed.

3. Claim Rejections - 35 USC § 103.

The Office Action rejected claims 1-20 under 35 U.S.C. §103(a) as being unpatentable over *May et al.* in view of *Briffa et al.* (U.S. Patent 6,075,411).

Newly-added claims 21-28 are identical to claims 30-37, respectively, that were rejected in a co-pending and related reissue patent application, serial no: 10/718,507. New claims 21-28 relate to similar subject matter as already claimed in claims 1-20 herein. The related reissue patent application is the parent of the present application. In the co-pending application, claims 30-37 there (21-28 here) were rejected under 35 U.S.C. §103(a) as being unpatentable over *May et al.* in view of *Cova* (U.S. Patent 6,141,390). The below-presented remarks will address the *Cova* reference as well as the *May et al.* and *Briffa et al.* references. Applicants respectfully request reconsideration of the rejections of claims 1-28.

At the effective filing date for the claims of the present application, the prior art included numerous examples of communications systems that included circuits for reducing the **p**eak-to-**a**verage **p**ower **r**atio (hereinafter referred to as PAPR circuits). The *May et al.* article discusses the mathematical basis for one such circuit in the context of OFDM modulation, but other PAPR circuits were known to those skilled in the art as indicated in the prior art of record.

The Office Action alleges that the *May et al.* article discloses those elements of applicants' claims that relate to a PAPR circuit. But each of applicants' claims also include limitations directed to a linearizer and power amplifier, or the like. The *Briffa et al.* and *Cova* references are alleged to teach linearizers. *Cova* teaches a digital implementation that predistorts at baseband, while *Briffa et al.* teaches of an analog implementation that predistorts at RF. The Office Action alleges that it would have been obvious to one skilled in the art to incorporate the *May et al.* teaching to adjust the amplitude and phase of the input signal. Applicants disagree and respectfully request reconsideration.

At the effective filing date for the claims of the present application, PAPR circuits were useful in limited situations where, for example, numerous communication signals were combined prior to power amplification, such as would occur with OFDM modulation. In this situation, on rare occasions the crests of the numerous communication signals will all add together, without any being subtracted away, to create a tremendously large amplitude peak. This tremendously large amplitude peak will seldom occur, so the average power will be remain much less than this large peak, and the peak-to-average power ratio will be high. It is usually difficult for a power amplifier to have a linear range that encompasses both the average and peak power when the peak is much greater than the average, but this difficulty can be overcome by using multiple power amplifiers and postponing the combination of communication signals until after the power amplifiers, or by using a more sophisticated and expensive power amplifier. To the extent that the peak extends into the nonlinear

range of the power amplifier, spectral regrowth occurs.

Spectral regrowth refers to an out-of-band RF emission from a transmitter. One does not prevent spectral regrowth. Rather, one typically reduces spectral regrowth to the extent that the out-of-band emissions are within some specification that may be imposed by governmental regulations and/or by a need to prevent interference with nearby channels.

An alternative to using more power amplifiers or the more sophisticated power amplifier to meet spectral regrowth requirements is the use of a PAPR circuit. But nothing comes for free. All PAPR circuits, including the arrangement mathematically suggested in the May et al article, reduce the peak-to-average power ratio by introducing in-band distortion to manipulate the communication signal's envelope so as to reduce the peaks. Thus, PAPR circuits were useful in only in limited circumstances. One example of such limited circumstances was when an entire communication system was being designed so that receivers could be designed with the transmitters that included PAPR circuits to accommodate the increased in-band distortion inserted by the PAPR circuits.

At the effective filing date for the claims of the present application, the prior art also included numerous examples of communications system that included predistortion circuits for the purpose of linearizing the power amplifier. The *Briffa et al.* and *Cova* patents represent two such examples, but the prior art at that time taught of others as well, as indicated by the prior art of record.

In all this prior art, nothing taught or suggested of using a PAPR circuit to drive a linearizing / predistortion circuit until applicants advocated this combination in the present application and its parent. This is not by accident. There is a reason why the prior art did not use PAPR circuits and linearizing circuits together. They were viewed by those skilled in the art as being mutually exclusive of one another.

In particular, linearizing / predistortion circuits were used in special purpose, high-end, niche communications applications. As is true for PAPR circuits, nothing comes for free with linearizing / predistortion circuits. The costs of linearizing / predistortion circuits are particularly high, and for those high costs only limited amounts of linearization are achieved. The background sections of *Cova* and *Briffa et al.* each tell of only being able to cancel distortions *to some extent*, of requiring a tremendous amount of processing of feedforward and/or feedback signals to be able to implement predistortion, of requiring circuits for processing the signals that were more troublesome than the minor improvement in linearity justified.

One limited niche application where a linearizing / predistortion circuit might be justified was where a single transmitter was required to communicate with a legacy population of a multiplicity of receivers. In such a situation, existing receivers could not be redesigned to accommodate greater in-band distortion. Thus, in-band distortion had to be held to a minimum at all costs so that the receivers could operate properly. *Cova*, in column 1 lines 34-42, suggests that a more sophisticated power amplifier operated at greater backoff would improve linearity, but would not improve phase distortion. Thus, a linearizing /

predistortion circuit has found a niche in going to extreme lengths to ameliorate in-band distortion introduced by the power amplifier. If out-of-band emissions were the concern, a more sophisticated power amplifier would be most probably be used and operated at greater backoff to improve linearity.

One skilled in the art would not combine a PAPR circuit with a linearizing / predistortion circuit because the PAPR circuit would introduce in-band distortion, and the linearizing / predistortion circuit would not be able to remove this PAPR-introduced, in-band distortion. In an application like *Cova*, where removing in-band phase distortion is critical, one would not introduce more in-band distortion. If the communication could tolerate an increase in in-band distortion, the designer would have avoided the inclusion of a linearizing / predistortion circuit altogether.

The Office Action suggests that one possible motivation for combining the *May et al.* PAPR circuit with *Briffa et al.* might be to adjust the amplitude and phase of the input signal. But this begs the question, and provides no motivation for making such a combination. The PAPR circuit already modifies amplitude and phase. One of skill in the art would not need to add a linearizing / predistortion circuit to do what has already been done. Likewise, a linearizing / predistortion circuit already modifies amplitude and phase; and, one would not add a PAPR circuit to do what is already being done.

Another niche where a linearizing / predistortion circuit might be justified is where high power and power efficiency are paramount concerns, as taught by *Briffa et al.* In *Briffa et al.* high power and power efficiency are of such paramount importance

that a nonlinear, class C power amplifier is used because of its desirable power efficiency. But a nonlinear, class C power amplifier produces absolutely horrendous out-of-band emissions when asked to reproduce an amplitude-modulated communications signal. The *Briffa et al.* linearizing / predistortion circuit is useful in this application because the resulting poor linearity is nevertheless a vast improvement in spectral regrowth when compared to using a non-linear, class C power amplifier without linearization, and the non-linear, class C power amplifier exhibits great power efficiency.

In an application like *Briffa et al.* where high power and power efficiency are the paramount concerns, a non-linear, class C amplifier is used. If a PAPR circuit were combined with such a non-linear, class C amplifier, the class C amplifier would strip out the envelope manipulation the PAPR circuit inserted. To some extent, the linearizing / predistortion circuit could then monitor the in-band-distorted, envelope-manipulated, PAPR signal and make adjustments so that the output more closely (but not precisely) resembles the in-band-distorted, envelope-manipulated PAPR signal. But better results would be obtained by omitting the PAPR circuit altogether and using the undistorted, non-envelope-manipulated communication signal to make adjustments so that the output more closely (but not precisely) resembled the undistorted, non-envelope-manipulated communication signal. One skilled in the art would not combine a PAPR circuit with a *Briffa et al.* linearizer only to achieve worse results.

In fact, *Briffa et al.* addresses and teaches a different solution for the "high-peak" problem that a PAPR circuit also addresses. As discussed in *Briffa et al.* at column 4 lines 62-67

and column 7 lines 49-57, the envelope of the input signal is clipped to approximately a hyperbolic tan shape to address the problem of when large peaks are present in the envelope. In short, *Briffa et al.* teaches to include a crude form of peak clipping within the linearizing / predistortion circuit. That way, some improvement is achieved rather than the worse situation that would result from driving a linearizing / predistortion circuit using a PAPR circuit. One skilled in the art would not be motivated to disregard the peak clipping taught by *Briffa et al.* and insert a PAPR circuit that would lead to worse results.

What applicants recognized was that a particular type of PAPR circuit as defined in applicants' claims would do an excellent job of reducing out-of-band distortions even while it increased in-band distortion. Then, what applicants (but not the prior art) further recognized was that due to this reduction of out-of-band distortion, for the first time it became practical to drive a linearizer, and in particular a digital linearizer as more-specifically claimed in claims 11 and 21, with such a PAPR circuit. A properly configured linearizer could actually be effective in reducing the out-of-band distortion to greater levels than had been previously achieved because the PAPR circuit would not override any such reductions achieved by the linearizer. The prior art did not suggest such a combination. Rather, the teaching of such a combination comes only from applicants' application.

Accordingly, applicants believe that the *May et al.* and either the *Briffa et al.* and/or *Cova* references were improperly combined and that applicants' claims 1-28 are allowable over the prior art of record. Reconsideration is respectfully requested.

4. Prior Art.

The examiner is respectfully requested to consider the prior art identified on the Supplemental Information Disclosure Statement that accompanies this Amendment.

In addition, the examiner's initials were inadvertently omitted next to the listing of the *May et al.* article and three Amoroso & Monzingo articles in the Information Disclosure Statement submitted by applicants when the application was filed. Since the *May et al.* article was used in rejecting claims 1-20, at least this item was obviously considered. Accordingly, applicants respectfully request the examiner to insure that the consideration of these articles be reflected in the record.

5. Conclusion.

Applicants believe that the foregoing amendments place the reissue application in a condition for allowance. Prompt reconsideration and favorable action are respectfully requested.

Respectfully submitted,

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